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CROSSBREEDING POULTRY FOR MEAT PRODUCTION

INCLUDING A FEEDING TEST OF TARO WASTE AND POI

by
CHARLES M. BICE, Poultry Husbandman
and
BENJAMIN A. TOWER, Assistant Poultry Husbandman

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CROSSBREEDING POULTRY FOR MEAT PRODUCTION

INCLUDING A FEEDING TEST OF TARO WASTE AND POI[1]

By
CHARLES M. BICE. Poultry Husbandman
and
BENJAMIN A. TOWER, Assistant Poultry Husbandman[2]

The production of quality market chickens is a problem of considerable importance to the poultry industry of Hawaii. For years emphasis has been placed on table-egg production, and most of the market poultry has been merely a by-product. The Hawaii Agricultural Experiment Station has been conducting an experiment to improve the quality of locally produced meat birds, toward which end Japanese Shamo Game males were mated with females of each of the three most popular breeds, Single Comb White Leghorn, Barred Plymouth Rock, and Rhode Island Red.

REVIEW OF THE LITERATURE

Previous experiments with crossbreeding of poultry have indicated that it is quite possible to reproduce certain traits of the parents in their progeny in addition to developing desirable hybrid vigor.

Warren showed that crosses involving Single Comb White Leghorns and Jersey Black Giants resulted in hybrid offspring superior to the purebred parents in hatchability of eggs, rate of growth, and egg production.[3] In a more comprehensive study on crossbreeding, in which Single Comb White Leghorns were crossed with Single Comb Rhode Island Reds, Single Comb White Leghorns with Barred Plymouth Rocks, and Single Comb Rhode Island Reds with Barred Plymouth Rocks, Warren (*10*)[4] also found that, in most instances, the hybrids excelled the purebreds on the above bases.

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[1] The work reported herein was conducted jointly by the University of Hawaii and the United States Department of Agriculture at the Hawaii Agricultural Experiment Station. Published with the approval of the Chief, Office of Experiment Stations, United States Department of Agriculture.
[2] Now Poultry Husbandman, Agricultural Extension Service.
[3] From footnote in literature cited subsequently, referring to previous work of Mr. Warren.
[4] Reference is made by number (*italic*) to Literature Cited, p. 19.

Horlacher and Smith (*4*) found crossbreds produced by Rhode Island Red hens and White Wyandotte roosters to be superior to purebreds of either breed for broiler production. The crossbreds grew more rapidly and required less feed per unit of gain, and there were no bare backs in the group. On the other hand, crossbreds from several other breeds were not so generally superior to both the parental breeds used in the crosses.

Jull (*5*) points out that numerous experiments on the inheritance of body weight of chickens have resulted in F_1 intermediate between the parents studied, and that more variation occurs in the F_2 than in the F_1. His studies indicate that body weight is an inherited characteristic.

Byerly, Knox, and Jull (*2*) found that crossing pure breeds is likely to increase hatchability, in inverse proportion to that of the parental breeds.

Knox and Olsen (*6*), experimenting with eggs from various breed crosses as compared with eggs from White Leghorns and from Rhode Island Reds, state that the viability of the hybrids was greater, but that the average crossbred chick was superior only in early body weight.

Thompson and Black (*9*) state that hybrid vigor is an important factor in early maturity, more uniform growth and development, and more efficient and profitable production, and should be of economic value by keeping the pullet flock in a more healthy state and reducing mortality.

Cushman (*3*) reported that the first generation hybrids of 12 different crosses were hardy and easy to raise.

Maw (*7*) has pointed out that the rate of growth of crossbred broilers was superior to that of the purebreds studied. A slight advantage appeared in favor of the purebred roasters at 26 weeks of age; however, in certain instances, the crossbred roasters had a greater percentage of flesh. Maw and Maw (*8*) state that the shape of the carcass is important in selecting breeding stock for the purpose of producing quality market poultry.

Waters (*11*) indicates that, unless great care is exercised in the selection of the parents to be used in crossbreeding, a single trait (such as slow feathering) may result in an undesirable dressed carcass.

The Japanese Shamo Game birds have full, deep, broad breasts, indicating good meat-carrying capacity, an important factor in producing

quality market poultry. Since the literature indicates that no work has been done with this breed, the study herein reported was undertaken in an effort to produce, by crossbreeding, rapidly growing hybrids with the broad breasts of the Shamo Game.

Plan of the Experiment

This experiment was initiated on April 15, 1936, and terminated June 1, 1937. Seven lots of hens were used (designated as lots 1 to 7 inclusive), each lot comprising 10 hens. The hens in each of the first

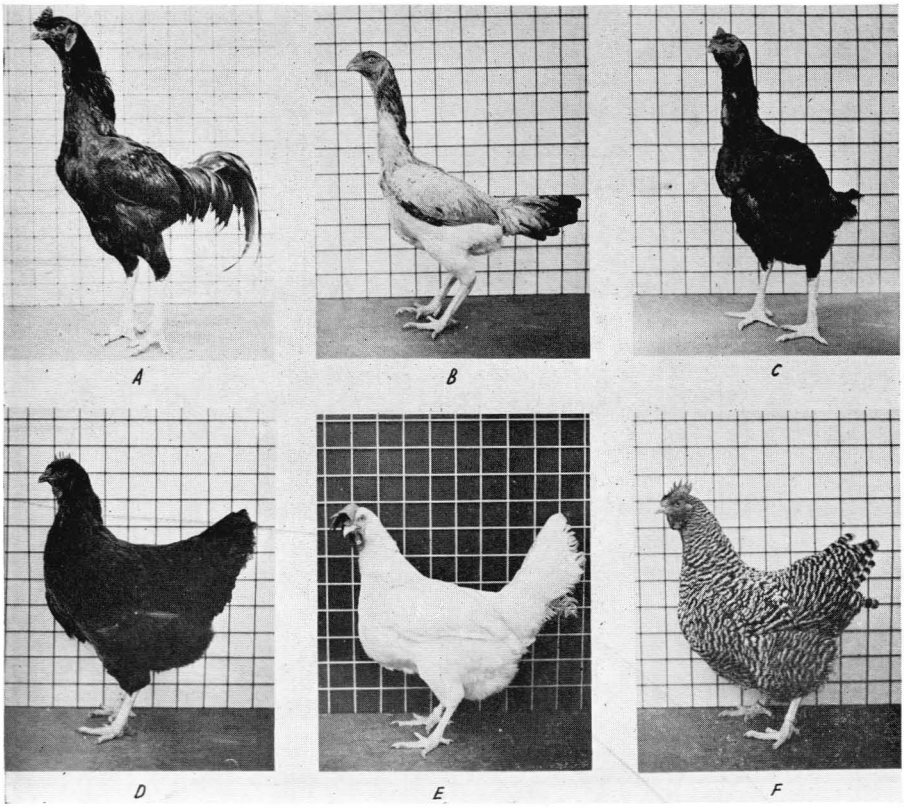

Plate 1—Varieties in experiment: (A) Purebred Japanese Shamo Game male; (B) purebred Japanese Shamo Game (wheaten) female; (C) purebred Japanese Shamo Game (black) female; (D) purebred Single Comb Rhode Island Red female; (E) purebred Single Comb White Leghorn female; (F) purebred Barred Plymouth Rock female.

three lots—Barred Plymouth Rocks, Rhode Island Reds, and Single Comb White Leghorns—were mated to a Japanese Shamo Game male. The hens in each of the other four lots—Japanese Shamo Games, Barred Plymouth Rocks, Rhode Island Reds, and Single Comb White Leghorns—were mated with a male of their same breed. The various lots were housed in specially constructed pens, and each had access to free range. All lots received a commercial mash-grain ration, supplemented with a moist-mash feeding at noon. Eggs for incubation were held for 14-day periods at 55° to 65° F. and were turned twice daily during the holding period.

Comparisons of the hybrids produced from the various crosses and the purebreds were on the following bases: Hatchability of eggs, chick mortality, feed consumption, and the rate of growth for the first 8 weeks. In addition, growth studies from 10 to 20 weeks and fattening trials for broilers, fryers, and roasters were conducted on selected groups.

All hybrid and purebred chicks were hatched in one incubator and raised, for 6 weeks, in battery brooders in the same brooder room. The chicks from each lot of hens were then transferred to a wire-floored house where they were kept until they reached the proper weights for their respective fattening trials. All chicks received the same commercial mash-grain ration.

A total of 2,380 chicks were hatched from the hens in the 7 lots; of this number only 1,434 were included in the records of incubation and growth and cost through 8 weeks of age. These chicks were weighed before being fed, between 7 and 8 o'clock in the morning, beginning at day-old and continuing at weekly intervals through the eighth week.

A select group of 750 chicks, 10 weeks of age, were weighed at 2-week intervals through the twentieth week. Growth records only were observed, as the primary objective was to determine the age at which the various market grades developed.

Hatching and Development of Chicks

Incubation Records

Table 1 shows the incubation records which were kept during the experiment.

TABLE 1.—Mating and incubation record of each lot.

Lot Number	Matings	Number of hatches	Total eggs set	Number of fertile eggs	Fertility	Chicks hatched	Hatchability of fertile eggs
				~~Percent~~	Percent		Percent
1	Japanese Shamo Game male × Barred Plymouth Rocks	6	516	372	72.1	235	63.2
2	Japanese Shamo Game male × Rhode Island Reds	6	539	413	76.6	259	62.7
3	Japanese Shamo Game male × Single Comb White Leghorns	6	651	501	76.9	329	65.7
4	Purebred Japanese Shamo Games	2	55	41	74.5	24	58.5
5	Purebred Barred Plymouth Rocks	4	422	302	71.6	167	55.3
6	Purebred Rhode Island Reds	4	268	227	84.7	152	67.0
7	Purebred Single Comb White Leghorns	3	661	500	75.6	268	53.6

These data show that both the percentage of fertility and the percentage of hatch of eggs were superior for the purebred Rhode Island Reds. Hatchability was consistently high, however, for eggs from cross matings, lots 1, 2, and 3 showing higher percentages of fertile eggs hatched than any purebred group other than lot 6.

EXTERNAL CHARACTERS OF DAY-OLD CHICKS AND OF ADULT HYBRIDS

Two groups of hybrid chicks were studied for characters which might aid in sex determination at hatching time. None of the various characters analyzed appeared to be sex-linked except the down markings of the Japanese Shamo Game—Barred Plymouth Rock hybrids. The females of this cross were entirely black while each male had a white spot on

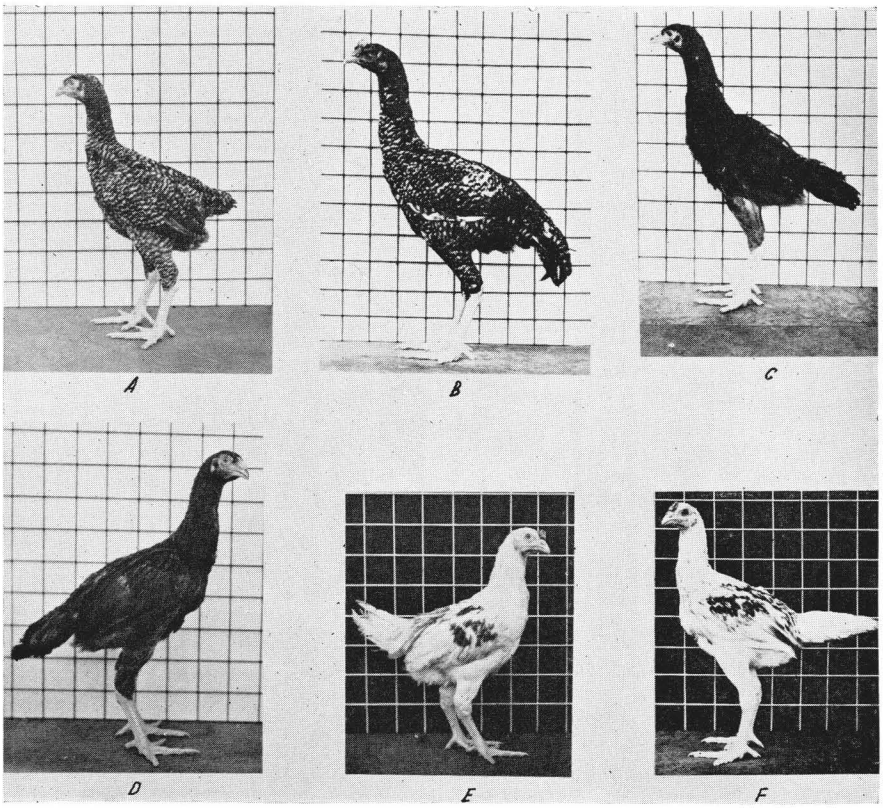

PLATE 2—Crossbred male broilers and fryers. Note junior plumage color pattern. (A) Hybrid Barred Plymouth Rock broiler; (B) hybrid Barred Plymouth Rock fryer; (C) hybrid Rhode Island Red broiler; (D) hybrid Rhode Island Red fryer; (E) hybrid White Leghorn broiler; (F) hybrid White Leghorn fryer.

his head. All hybrids were pea-combed, indicating dominance of the Japanese Shamo Game type of comb.

The adult males of the Barred Plymouth Rock cross had barred plumage, whereas the females were black. In the White Leghorn hybrids, three color variations were noted among the females—white, white splashed with black, and white with roan markings over the entire body. The males of this cross were white with red splashes over the wing bows and shoulders. The Rhode Island Red crossbred females varied in plumage pattern from a wheaten color to a deep red, whereas all males were red. The Japanese Shamo Game body type was dominant

in the three crosses observed. Plate 1 shows the external characters of the four parent varieties; plates 2 and 3 show the hybrid chickens at their three market classifications: broilers, fryers, and roasters.

Chick Mortality

Data on chick mortality through the eighth week are presented in table 2.

Table 2.—Chick mortality through the first 8 weeks of the experiment.

Matings	Total number of chicks	Total mortality—8 weeks	Percentage of mortality
Japanese Shamo Game male × Barred Plymouth Rocks	235	11	4.68
Japanese Shamo Game male × Rhode Island Reds	259	7	2.70
Japanese Shamo Game male × Single Comb White Leghorns	329	24	7.29
Purebred Japanese Shamo Games	24	2	8.33
Purebred Barred Plymouth Rocks	167	13	7.78
Purebred Rhode Island Reds	152	10	6.58
Purebred Single Comb White Leghorns	268	36	13.43

These data indicate that the mortality for each of the three crossbred groups was considerably lower than that for the comparable purebred group. The crossbred Leghorns show a slightly higher rate than the purebred Rhode Island Reds, but lower than any other purebred group. The mortality of the crossbred Rhode Island Reds is lowest among the hybrids.

Rate of Growth Through 8 Weeks

Average interval weights of all chicks are presented in table 3. The weights through the sixth week were the averages of the males and females, after which time the males and females were weighed separately. The weighings were discontinued after the eighth week, and the different lots of crossbreds were held for the fattening phase of the experiment. The original number of chicks in each lot was the same as shown in table 2.

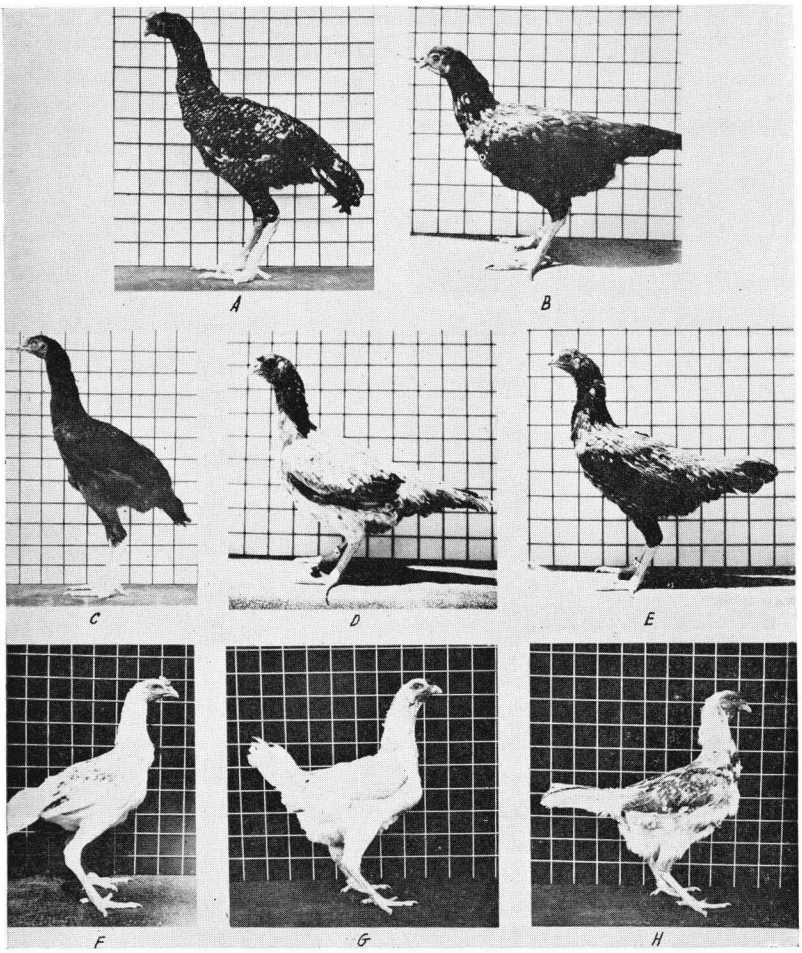

PLATE 3—Body type and adult plumage color pattern of hybrids: (A) Hybrid Barred Plymouth Rock male; (B) hybrid Barred Plymouth Rock female; (C) hybrid Rhode Island Red male; (D) hybrid Rhode Island Red female (splashed red); (E) hybrid Rhode Island Red female (solid red); (F) hybrid White Leghorn male; (G) hybrid White Leghorn female (splashed with black); (H) hybrid White Leghorn female (roan).

TABLE 3.—Average weights of chicks through 8 weeks of age.

Matings	1 day old	2 weeks old	4 weeks old	6 weeks old	8 weeks old	Average gain
	Ounces	Ounces	Ounces	Ounces	Ounces	Ounces
Japanese Shamo Game male × Barred Plymouth Rocks	1.3	3.9	8.6	14.1	23.5 (21.6[1] 25.5[2])	22.2
Japanese Shamo Game male × Rhode Island Reds	1.5	4.2	9.4	16.1	24.5 (22.5 26.6)	23.0
Japanese Shamo Game male × Single Comb White Leghorns	1.3	4.0	9.8	16.6	23.3 (22.1 24.5)	22.0
Purebred Japanese Shamo Games	1.3	3.9	10.0	17.1	23.6 (22.6 24.4)	22.3
Purebred Barred Plymouth Rocks	1.3	3.7	8.4	13.0	21.6 (20.5 22.6)	20.3
Purebred Rhode Island Reds	1.4	3.7	8.2	13.8	20.4 (18.3 22.6)	19.0
Purebred Single Comb White Leghorns	1.3	3.5	8.0	13.8	20.6 (19.3 21.8)	19.3

[1]Females. [2]Males.

The data presented in table 3 show that the males of the Rhode Island Red—Shamo Game cross were heavier at 8 weeks than those in the other lots, with the males of the Barred Plymouth Rock—Shamo Game cross second, and the White Leghorn—Shamo Game cross following. Of the purebred groups, the Shamo Game males were outstandingly the heaviest. The purebred Shamo Game females made more rapid growth than any of the crossbred lots, but none of the other purebred females could compare favorably.

The following table shows the average feed consumption and cost per pound of gain for the chicks in the 8 weeks' growth studies.

TABLE 4.—Feed consumption, feed costs, and the gain in weight of the various lots from day-old chicks through the eighth week.

Matings	Lots	Number of birds	Average feed consumption per bird	Total feed cost per bird[1]	Average gain in weight	Feed per pound of gain	Feed cost per pound of gain
			Pounds	Cents	Pounds	Pounds	Cents
Japanese Shamo Game × Barred Plymouth Rocks	1	235	3.56	11.74	1.39	2.56	8.45
Japanese Shamo Game × Single Comb Rhode Island Reds	2	259	4.01	13.23	1.44	2.78	9.19
Japanese Shamo Game × Single Comb White Leghorns	3	329	3.53	11.65	1.37	2.58	8.50
Purebred Japanese Shamo Games	4	24	4.08	13.46	1.39	2.94	9.68
Purebred Barred Plymouth Rocks	5	167	4.23	13.96	1.27	3.33	10.99
Purebred Rhode Island Reds	6	152	4.73	15.61	1.19	3.97	13.12
Purebred Single Comb White Leghorns	7	268	4.80	15.84	1.21	3.97	13.09

[1] Feed cost 3.3 cents per pound.

These data show that the crossbreds ate less feed per bird, through the eighth week, than did the purebreds. The gains in weight, as previously indicated, were superior in the crossbred groups as compared with the purebred groups. It may be seen that the crossbreds made more efficient use of their feed than did the purebreds and, consequently, they cost less to produce up to 8 weeks of age. This is of economic importance to the poultryman who is interested in the production of quality market poultry at a profit.

GROWTH STUDIES FROM TEN TO TWENTY WEEKS

For further studies on the growth of crossbred chicks, one lot each of crossbred White Leghorns, crossbred Rhode Island Reds, and crossbred Barred Rocks were weighed at 2-week intervals beginning with the

tenth week, and the weights are presented in table 5. Each lot comprised 125 males and 125 females but the male Leghorns were disposed of at the end of the tenth week, due to coccidiosis.

TABLE 5.—Average weights of crossbreds from tenth week through the twentieth week.

Average age	Japanese Shamo Game × Barred Plymouth Rock		Japanese Shamo Game × Rhode Island Red		Japanese Shamo Game × Single Comb White Leghorn	
	Male	Female	Male	Female	Male	Female
Weeks	Ounces	Ounces	Ounces	Ounces	Ounces	Ounces
10	33.4	30.4	36.2	29.0	34.6	30.1
12	44.3	37.3	46.6	37.8		37.1
14	51.7	46.6	55.4	47.5		43.5
16	57.1	53.3	64.8	52.5		47.2
18	61.1	58.9	72.8	57.8		53.0
20	66.6	62.1	79.0	61.8		53.8
Average gain....	33.2	31.7	42.8	32.8		23.7

Of the hybrids studied to determine ages at which the different market classes were reached, the Japanese Shamo Game—Rhode Island Red cross, particularly the males, made outstandingly better gains than the other groups.

FATTENING PHASE

In the fattening trials, 2,170 birds varying from broiler to roaster stage were crate-fattened, with 3 fattening rations. All birds were fasted for 24 hours before the initial weights were recorded, and for 12 hours prior to all other weighings. Buttermilk, at the rate of 1 pound of dried buttermilk to 9 pounds of water, was used with all rations, bringing the mixtures to such consistency that they would pour easily from a pail. The birds were given three 15-minute feeding periods the first day, at 7 a.m., 12 noon, and 5 p.m. Twenty minutes were allowed for each feeding period on the second day, and 30 minutes for each meal from the third day to the end of the tenth day. All feed not consumed during these periods was removed to insure good appetites at the next feeding. No water was given throughout the experiment. The fattening trials were conducted in a room with subdued lighting to control can-

nibalism. At the end of the tenth day the birds were starved for 18 hours before being killed. The percentage of dressing loss was determined for each bird, and from these data the average dressing loss for each lot was obtained. The birds were killed by the "stick" method, and dressed by the "semi-scald" method.

Composition and Cost of Fattening Rations

In table 8 are shown the compositions and costs of the fattening rations fed in these trials. No. 1 is a standard fattening ration; to No. 2 and No. 3, respectively, have been added the local products, poi and tar waste. Poi has been described (*1*) as "a carbohydrate (starchy food) prepared by allowing the crushed steamed corms of the taro plant to undergo an acid fermentation due primarily to bacteria, and secondly to species of yeast, mycoderms and oidia." Taro waste includes the peels and eyes of the corms, which cannot be used in poi making.

Table 6.—Composition and cost of fattening rations

Ration number	Composition		Cost of ingredients	Cost of 100 pounds of mixture[1]
	Ingredient	Percent	Dollars	Dollars
1	Wheat middlings..	40	0.82	
	Corn meal.....	60	1.47	2.29+1.42=3.71
	Taro waste	40	.20	
2	Wheat middlings..	40	.82	
	Corn meal.....	20	.49	1.51+1.42=2.93
	Poi	40	1.00	
3	Wheat middlings..	40	.82	
	Corn meal.....	20	.49	2.31+1.42=3.73

[1] The dried buttermilk was not measured with the feed, but on the basis of $64 of buttermilk used during the experiment with 4,518 pounds of feed consumed, the cost of buttermilk has been estimated at $1.42 per 100 pounds of feed.

Results of Fattening Phase

The standard ration (No. 1) was fed to lots of the three crossbred and three purebred groups, at each of the three market classes. The purebred Japanese Shamo Games were not available in sufficient number for comparison in these trials. Table 7 gives the data thus obtained. For both broilers and fryers economic superiority, on the basis of cost

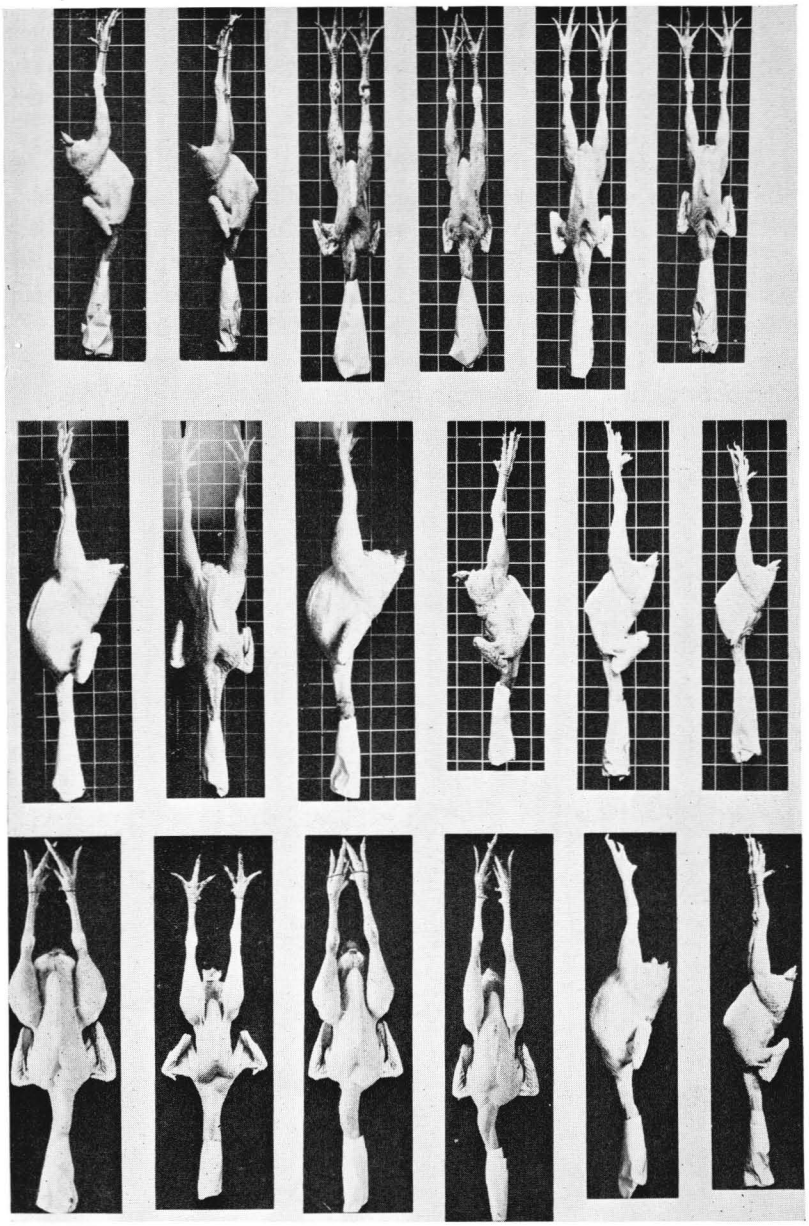

PLATE 4—*Top row*—broilers, left to right:
Hybrid Barred Plymouth Rock; purebred Barred Plymouth Rock; hybrid Rhode Island Red; purebred Rhode Island Red; hybrid White Leghorn; purebred White Leghorn.
Middle row—fryers:
Hybrid Barred Plymouth Rock; purebred Barred Plymouth Rock; hybrid Rhode Island Red; purebred Rhode Island Red; hybrid White Leghorn; purebred White Leghorn.
Bottom row—roasters:
Hybrid Barred Plymouth Rock; purebred Barred Plymouth Rock; hybrid Rhode Island Red; purebred Rhode Island Red; hybrid White Leghorn; purebred White Leghorn.

per pound of gain, was in the order of hybrid Plymouth Rocks, Rhode Island Reds, and Leghorns, followed by the purebreds. In a few cases higher dressing loss would somewhat offset the lower feed consumption per pound of gain.

Dressed carcasses of the crossbred chickens, particularly the broilers, were superior in appearance (see plate 4). The Leghorn hybrid made the most attractive carcass, due, no doubt, to absence of dark pinfeathers.

The fattening trials for roasters indicated that the hybrid Rhode Island Reds and Barred Plymouth Rocks made more economical gains than the comparable purebreds. The purebred White Leghorns were superior in this respect to any but the crossbred Plymouth Rocks, but their dressing loss was extremely high.

TABLE 7.—Results of the fattening trials with broilers, fryers, and roasters, fed ration No. 1

Breeding	Number of birds	Initial weight	Final weight	Gain in weight	Dressed weight	Dressing loss	Average feed consumed per bird[1]	Feed per pound of gain[1]	Total cost of gain[2]	Cost per pound of gain[2]
		Pounds	Pounds	Pounds	Pounds	Percent	Pounds	Pounds	Cents	Cents
Broilers—										
Hybrid Barred Plymouth Rocks....	100	1.97	2.60	0.63	2.38	8.46	1.70	2.70	6.31	10.02
Hybrid Rhode Island Reds.....	100	2.03	2.63	.60	2.43	7.60	1.73	2.88	6.42	10.68
Hybrid Single Comb Leghorns.....	135	1.80	2.30	.50	2.10	8.70	1.50	3.00	5.56	11.13
Purebred Barred Plymouth Rocks	100	1.91	2.32	.41	2.09	9.91	1.79	4.36	6.64	16.18
Purebred Rhode Island Reds.....	100	2.06	2.66	.60	2.46	7.52	2.00	3.33	7.42	12.35
Purebred Single Comb Leghorns..	100	1.42	1.83	.41	1.71	6.55	1.30	3.17	4.82	11.76
Fryers——										
Hybrid Barred Plymouth Rocks....	100	2.76	3.45	.69	3.19	7.53	2.09	3.03	7.75	11.24
Hybrid Rhode Island Reds.....	100	2.81	3.46	.65	3.23	6.65	2.02	3.10	7.49	11.50
Hybrid Single Comb Leghorns.....	135	3.36	3.95	.59	3.58	9.37	2.57	4.36	9.53	16.18
Purebred Barred Plymouth Rocks	100	2.71	3.39	.68	3.08	9.15	3.17	4.66	11.76	17.29
Purebred Rhode Island Reds.....	100	3.38	3.92	.54	3.56	9.18	2.36	4.37	8.76	16.21
Purebred Single Comb Leghorns..	100	3.05	3.46	.41	3.15	8.96	1.95	4.75	7.23	17.62
Roasters—										
Hybrid Barred Plymouth Rocks....	50	5.38	6.09	.71	5.67	6.90	1.58	2.23	5.86	8.27
Hybrid Rhode Island Reds.....	50	4.44	5.03	.59	4.61	8.35	2.13	3.61	7.90	13.39
Hybrid Single Comb Leghorns.....	50	4.64	5.22	.58	4.72	9.58	2.92	5.04	10.83	18.70
Purebred Barred Plymouth Rocks	50	3.15	3.50	.35	3.21	8.29	1.92	5.49	7.12	20.37
Purebred Rhode Island Reds.....	50	4.80	5.31	.51	4.82	9.23	2.56	5.02	9.50	18.62
Purebred Single Comb Leghorns..	50	4.29	4.97	.68	4.19	15.69	2.44	3.59	9.05	13.32

[1]These figures do not include the amount of powdered buttermilk.
[2]On basis of dry feed plus buttermilk (see table 6).

Feeding Test of Taro Waste and Poi

Table 8 shows the results of several fattening trials designed to test the relative efficiency of crossbred and purebred broilers in utilizing special rations which include local foodstuffs. The hybrids in every case made more economical gains than the purebred chickens, with lower dressing losses in general.

Comparison with broilers fed the standard ration (table 7) indicates that the taro-waste supplement served to reduce cost of gain for hybrids although not for the purebreds. Poi did not prove to be as economical as either of the other two rations.

TABLE 8.—Results of purebred and crossbred Single Comb White Leghorn, Barred Plymouth Rock, and Rhode Island Red broilers fed fattening rations containing 40 percent taro waste, and Single Comb White Leghorn broilers fed rations containing 40 percent poi.

Breeding	Ration number	Number of birds	Initial weight	Final weight	Total gain in weight	Dressed weight	Dressing loss	Average feed consumption[1]	Feed per pound of gain[1]	Total cost of gain[2]	Cost per pound of gain[2]
			Pounds	Pounds	Pounds	Pounds	Percent	Pounds	Pounds	Cents	Cents
Barred Plymouth Rock (cross)	2	75	2.17	2.89	0.72	2.68	7.3	1.88	2.61	5.51	7.65
Rhode Island Red (cross)	2	75	2.19	2.80	.61	2.67	4.6	1.88	3.08	5.51	9.02
Single Comb White Leghorn (cross)	2	75	1.42	1.90	.48	1.77	6.8	1.83	3.81	5.36	11.16
Barred Plymouth Rock (pure)	2	75	2.71	3.39	.68	3.08	9.1	3.18	4.68	9.32	13.71
Rhode Island Red (pure)	2	75	2.43	3.16	.73	2.86	9.5	3.60	4.93	10.55	14.44
Single Comb White Leghorn (pure)	2	75	1.54	1.87	.33	1.67	10.7	1.46	4.42	4.28	12.95
Single Comb White Leghorn (cross)	3	75	1.81	2.25	.44	1.98	12.0	1.70	3.86	6.34	14.40
Single Comb White Leghorn (pure)	3	75	1.44	1.81	.37	1.68	7.2	1.54	4.16	5.74	15.52

[1]These figures do not include the powdered buttermilk.
[2]On basis of dry feed plus buttermilk (see table 6).

CONCLUSIONS

1—The percentage of hatchability, based on the fertile eggs set, is definitely higher in the hybrid lots than in any purebred lot except Rhode Island Reds.

2—The only sex-linked character found in day-old chicks in these experiments was in the hybrid Plymouth Rock chicks; the males are black with a white spot on the head, and the females entirely black.

3—All hybrid offspring were pea-combed, showing that the Japanese Shamo Game comb was dominant over comb types of the female parents.

4—The crossbreds in each group had a lower mortality rate than the purebreds of the corresponding group.

5—Hybrids grew more rapidly and ate less feed through 8 weeks of age than purebreds except Shamo Games and their costs per pound of gain were less.

6—Cost per pound of gain for both broilers and fryers was lowest in the hybrid Plymouth Rocks, followed by hybrid Rhode Island Reds and Single Comb White Leghorns.

7—Hybrid Barred Plymouth Rock and Rhode Island Red roasters cost less to produce than the comparable purebreds.

8—Dressed carcasses of hybrid birds were more attractive than those of the purebred groups; absence of pinfeathers on hybrid White Leghorns increased the superiority of that breed.

9—Taro waste proved to be an economical ingredient in poultry feed; poi, on the other hand, produced more expensive gains than the standard ration when fed to Single Comb White Leghorn broilers only.

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